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tion changing the general administration of the office, unless the proposed abolition of the 'study-room' and of the school at Fort Meyer be considered such. The commission says that any intelligent young man of good education can learn every thing necessary to the practical work of an observer in six weeks, and sees no occasion for so elaborate a scheme of instruction as that provided. It is not, however, intended to dispense with the services of the able meteorologists who have been employed by the office.

On the question of the military control of the meteorological service, the report is extremely mild. It is found that the work is in no sense military, and that military discipline and law are not necessary to its efficiency. If the question were a new one, whether a civilian bureau with a civil head should be established rather than an extension of a military bureau, the commission would recommend this rather than a military organization. As the matter stands, the commission is equally divided on the question of leaving the service in its present hands. Three do not see why it cannot be as well managed by the chief signal-officer of the army as by a civilian head; three think such a head necessary to its efficiency. All, however, are in favor of cutting down the military staff as it now exists. As with the other bureaus, the commission does not find that congress can advantageously define the operations of the signal-office by other legislation than such limitations as may be imposed on expenditures in framing the appropriation bills.

The principal minority report is signed by Senator Morgan and Representative Herbert. It consists largely of severe criticisms upon the work of both the coast and geological surveys. The topographical system of the coast survey is strongly condemned on the score of extravagance in delineating minute features of no use whatever to the navigator, and of little or no use to any one else. It favors the transfer of the office to the navy, and would abolish entirely the further prosecution of other geodetic measurements than are necessary to map-making.

Such are the main points of the report. Comment is unnecessary, because there is no reasonable chance of legislation on the subject. The surveys will be left, as they have heretofore been left, in the hands of the appropriation committees. It is expected that the house committee will sympathize with the minority rather than the ma-

jority, so far at least as the coast survey is concerned, and will therefore be disposed to reduce the appropriations to the lowest limit, and perhaps cut down the force also.

#### *HATCHING, REARING, AND TRANSPLANTING LOBSTERS.*

THE experiments of Dannevig in hatching the ova of the European lobster, naturally awakened an interest in the propagation of the American species, which, as has been shown by Mr. Rathbun, is becoming less abundant on what were formerly the best lobster-fishing grounds on our coast. This depletion of the supply of lobsters is very probably due in large part to the fact that vast numbers of females are annually caught and killed, together with the many thousands of eggs hanging to their abdominal legs. It happens in this way that not only the individuals most directly concerned in reproducing their species are destroyed, but that almost countless millions of partly developed young are also sacrificed, in the ordinary process of supplying the markets with this crustacean.

Recent experiments under the direction of Capt. H. C. Chester at the U. S. fish-commission station at Wood's Holl, Mass., have demonstrated that it is possible to hatch the ova of the lobster in unlimited quantities in the same device in which the ova of the cod were successfully hatched last year. The eggs, at any stage, may, in fact, be removed from the parent female without injuring her, or an appreciable number of ova making up the masses of eggs hanging to her swimmerets. The eggs, if then placed in the hatching-apparatus, will develop and become embryos, which will free themselves from their investing envelopes in due course of time. The length of the period of incubation is not known, as artificial fertilization of the eggs of this creature is not practicable; though with greater experience, and a wider range of accurate observation, it may soon be possible to state the length of that period pretty accurately. The approach toward the completion of development in the egg is marked by the gradual diminution in the bulk of the yolk, as a result of which the eggs become more and more translucent; so that, by the time they are ready to hatch, they are dirty-yellowish in color instead of dark greenish-brown as at first. At the same time the ova become larger by about one-half their original diameter. Towards the close of the period of development, the eggs also lose their original globular form, and become decidedly oval. During the later stages of development the eggs show

a great range of variation in color, a few being bright crimson-red, while the majority are of a dirty greenish-yellow tint. Similar variations in color are apparent in the young after hatching, and are apparently due, as in the case of the eggs, to the presence of an unusual number of red-pigment cells.

Immediately after hatching, the young swim about in the sea-water, and will at once begin to feed, even killing and eating each other if food is not soon offered them. Minced crab or lobster meat is greatly relished. The recently hatched lobsters are also attracted by the light, and will always collect at the side of the aquarium or tank nearest the source of light. At night, or if the light is shut off, the young lobsters go to the bottom of the tanks; and it seems that they may then be most actively engaged in feeding if food is placed within their reach.

When first hatched, the young lobster measures one-third of an inch long, and is provided with cephalothoracic appendages only. The tail, unlike that of the just hatched crayfish, is without swimmerets. The five thoracic appendages, unlike those of the adult or those of the young crayfish, are biramose, the outer branches or rami being flattened, and fringed with plumose setae. These outer branches of the limbs are rapidly vibrated to and fro, and constitute the principal locomotive appendages of the young lobster during the pelagic stage of its existence, acting like paddles or oars and independently of the inner rami, which are used mainly as prehensile organs. The inner rami of the appendages afterwards become the permanent thoracic limbs, while the outer ones abort.

When from four to six days old, they moult for the first time; and it is noticed that in doing so they suddenly increase in length and bulk, since they now measure nearly half an inch in length. They also, at this time, acquire four pairs of abdominal legs or swimmerets; but the telson is still formed of a broad, single, triangular piece, emarginate posteriorly, and not rounded and serrated behind as in the young crayfish. The pincers of the first pair of thoracic limbs become distinctly developed at the first moult.

It is obvious, from what has preceded, that the lobster passes through a schizopod stage, as pointed out by S. I. Smith. This stage has been omitted in the ontogeny of the crayfish. The young also evidently abandon the mother lobster at once, the blades of their pincers being without hooked tips for clinging to the mother, as in the recently hatched crayfish.

In the course of about eight days more, the young lobsters probably moult again,—a process

which is repeated for the third time in the course of perhaps ten days more, when they will measure about five-eighths of an inch long, and when they have acquired an additional pair of appendages, so that they then have all that are possessed by the adult.

The young lobster probably moults twice more before it is sixty days old, by which time its antennae become fully developed and flagelliform, while its telson loses its larval form, and the animal has thus completed its metamorphosis. It now measures about an inch in length, and is occasionally taken at the surface in a tow-net, though it is probable that it now usually remains at the bottom, concealing itself among the seaweeds and stones, lying in wait for its prey.

Recent experiments conducted by Captain Chester, at Wood's Holl, have demonstrated that it is possible to keep the adult lobsters alive for an indefinite period in a moist, cold atmosphere. These conditions may be most readily satisfied by packing the lobsters between layers of wet seaweed in a metal box with a perforated cover; this metal box being then placed in a larger wooden box, and surrounded with cracked ice, which will cool the contents of the inner box down to 45° F. At this temperature, in this device, lobsters have been kept alive and in good condition for fifteen days, and in a moist atmosphere only; their gills not having been immersed in water during the whole period. Even the eggs hanging to the swimmerets of the females so treated are not injured in the slightest degree, and will continue to develop normally if put into the hatching-jars. The adults also, if taken out of the seaweed in the metal box, and put into sea-water, have the moist air in the gill-chambers at once replaced by the water, and begin to move about as if nothing had happened to them.

This important discovery renders it possible to transport living adult lobsters across the continent, and to stock the waters of the Pacific coast with this important crustacean. It is also possible to pack the eggs in seaweed in a similar manner, and transport them for long distances, after which they may be hatched and reared up to an inch in length by artificial means. This will render it possible to collect lobster-eggs to the number of many millions at several points over the fishing-grounds, and bring them to a great central hatching and rearing establishment, such as that at Wood's Holl, where at least a hundred million eggs may be cared for at one time. The work of propagating the lobster, the cod, and other fishes, will then keep the station at Wood's Holl in practical operation, in an economic direction, for the entire year. The recent successes at

this station, in artificially hatching the mackerel and tautog, indicate that the application of the methods of artificial propagation are capable of still further extension. At present the propagation of the lobster is of the greatest practical importance ; and the possibility of feeding and caring for the young in large quantities till they have attained the length of one inch, when they practically abandon their pelagic habits and are able to take care of themselves, seems to be assured.

JOHN A. RYDER.

#### ROYAL GEOGRAPHICAL SOCIETY.

THE anniversary meeting of this society was held on Monday, May 24, with the president, the Marquis of Lorne, in the chair. The report of the council showed that 173 fellows had been elected during the year, besides three honorary corresponding members. The losses had been, by death 63 (besides one honorary corresponding member), by resignation 75, and by removal 21, making the net increase for the year 16. The total number of fellows on the list, exclusive of honorary members, on May 1, was 3,407.

The president said he considered himself most fortunate in that it was his duty to present to Mr. Phelps, as the representative of America and of his distinguished countryman, Major Greely, the queen's medal for this year. It was the sixth occasion on which a president of that society had greeted the achievements of a citizen of the United States with that honor. In the year 1855 it was accorded to Dr. Kane, who had charge of the expedition generously fitted out by the republic to search for Sir John Franklin. Again, in the year 1867, Sir Roderick Murchison, then president, was able to place in the hands of the American minister the gold medal given to another of his countrymen, namely, Dr. Hayes, who had reached a more northern point of land than any before attained. Dr. Hayes had himself been the companion of Kane, and was the discoverer of that very land, named after Henry Grinnell of New York, which had been the scene of the explorations of Major Greely.

The president then presented the patron's medal to Signor Guido Cora (*Science*, May 28).

The Murchison grant for 1886 was awarded to the brothers F. and A. Jardine, for their remarkable journey overland to the settlement of Somerset at Cape York (Queensland) from May, 1864, to March, 1865, during which they solved the question of the courses of the northern rivers emptying into the Gulf of Carpentaria, and definitely ascertained the area of the York Peninsula adapted for pastoral occupation.

The Back grant for 1886 was then awarded to Sergeant David L. Brainard, in recognition of the effective services rendered by him during the various explorations carried out by the American Arctic expedition of 1881-84.

The president remarked that the active work of the society during the past year had been largely directed towards initiating improvement in geographical education.

The report of the society's inspector, Mr. Keltie, describes the results of Mr. Keltie's visits to universities and schools at home and abroad for the purpose of inquiring into the position of geography in education : it had attracted much attention at home and abroad, and, it was believed, had been productive of good results. The interest excited by the society's recent action had been so great, and the expectation that they should continue it by taking some positive steps towards encouraging improvements in the position of geography in schools and universities was so general, that the council had felt encouraged, and indeed bound, to carry the scheme further. The educational committee of the society therefore made certain suggestions to the council, which were now under consideration, and would probably be adopted. The principal of these suggestions related to the appointment of a lecturer in geography, to deliver courses where the council might direct.

In order still further to encourage the scientific study of geography at the universities, the committee suggested that a prize or travelling scholarship should be given every alternate year to a student who had shown marked ability in geographical subjects, and who might desire to visit one of the less-known districts of Europe, or the Mediterranean or Black Sea shores, and any results to be communicated to the society. One or other of the annual grants which were at the society's disposal might be devoted to this purpose.

Another suggestion was aimed at reaching the intelligent middle and working classes through the medium of the university extension scheme. For this purpose a small annual grant was proposed. Another was that a medal be given by the society to the student reported by the examiners to have done best in physical geography in the first part of the natural sciences tripos (honors examination).

And finally, in order that all classes of schools might be reached, it was proposed that prizes be offered for competence in geography to the students at the various training-colleges. Here they reached the fountain-head of education ; and, if they could secure adequate attention to geography in the institutions which sent forth yearly troops